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Investigation of the instant effect of Kinesio Taping on the rectus femoris muscle on pain and functional disability in knee osteoarthritis patients

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ABSTRACT

Aims: The aim of this study is to determine the instant effect of kinesio taping applied to the rectus femoris muscle on pain and functional disability in patients with knee osteoarthritis

Methods: Forty individuals diagnosed with osteoarthritis were included in the study and were divided into two groups as Kinesio tape (KT) and placebo groups. Kinesio taping was applied to both rectus femoris of the participants for 30 minutes with the facilitation technique in the intervention group and without tension in the placebo group. We assessed participants for pain and functional disability Western Ontario and McMaster Osteoarthritis Index (WOMAC).

Results: Demographic and clinical characteristics of the groups before these interventions were similar ($p > 0.05$). WOMAC pain, WOMAC function and WOMAC total score improved significantly for the KT group between pre-post taping results ($p<0,05$). There was no significant difference between the pre-post taping in WOMAC stiffness section ($p>0,05$).

Conclusion: It was concluded that KT applied bilaterally to the rectus femoris did not affect stiffness in patients with knee OA, but instantly improved pain and functional disability.

Keywords: Kinesio tape, knee osteoarthritis, pain; functional disability

INTRODUCTION

Osteoarthritis (OA) is a chronic, multifactorial and degenerative disease that occurs mainly in cartilage, subchondral bone, synovium and muscles. It is characterized by joint space narrowing, articular cartilage defect, subchondral bone destruction, and synovial membrane thickening.[1] The joint is the most affected part of the body in knee OA, and the number of patients with knee OA has increased in parallel with the aging of the population and remains a major health challenge.[2]

Knee OA patients experience inflammation, pain, stiffness, muscle atrophy and functional disability, and these findings lead to a decrease in quality of life.[3] The aim of conservative treatment in knee osteoarthritis is to minimize pain, limit functional disorders and improve physical function in patients. Current knee OA treatments aim to alleviate these symptoms through a variety of methods, including pharmacological, non-pharmacological, surgical and non-surgical interventions.[4] Among non-pharmacological modalities, kinesio taping has gained popularity in recent years. Cost-effective interventions with minimal side effects are therefore encouraged, previous studies recommending the use of therapeutic taping techniques/interventions as a practical solution in knee OA.[5]

Kinesio taping has been proven to be a short-term intervention for knee pain in cases of knee OA by correcting the misaligned knee joint and reducing the load on the inflamed soft tissue. It causes quadriceps muscle weakness, stiffness in the knee joint, decreased ROM in the joint, pain and functional disability in knee OA patients. Often, the pain and physical impairments/injuries associated with knee OA are caused by quadriceps weakness, benefiting from taping.[6]

Kinesio taping is a method that is frequently applied to affect different physical problems. It has been reported that kinesiology taping application provides improvement in pain, limitation of joint movement, muscle strength activation and proprioceptive changes.[7] Facilitation taping, which is one of the kinesiological taping techniques, is a technique that affects the golgi tendon organ, stimulates the muscle to which it is applied and contributes to the function of the muscle.[8]

It has been reported that kinesiology taping has significant effects on pain, physical performance, muscle strength and range of motion in knee OA patients 6. In another study in

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which kinesiology taping was applied, better proprioceptive sensitivity was found, as well as improvements in pain and joint range of motion in knee OA patients.[9] There are studies in the literature examining the long or short-term effects of kinesiology taping on pain, physical performance, and active range of motion in knee OA patients. Significant improvements were noted in some of them compared to the placebo group.[10-12] while in some, no significant difference was found.[13]

Although previous studies have shown that Kinesio Taping is effective in knee disease, there is still no reliable evidence and the effect of Kinesio Taping on knee OA is still controversial. Studies examining the immediate effect of kinesiology taping in knee OA, which are less emphasized than the long or short-term effects, have examined the effects on pain, function, range of motion, balance, proprioception, but the studies are insufficient and the evidence for the method to be applied and the duration of KT application is insufficient. Therefore, the aim of our study is to determine the immediate effect of kinesiology taping on the rectus femoris muscle on pain, stiffness, and functional disability in patients with knee osteoarthritis.

METHODS

This study was carried out in the Physical Therapy and Rehabilitation Unit of Kırıkkale University Faculty of Medicine between October 2021 and February 2022. Our study was approved by Kırıkkale University Non-invasive Researches Ethics Committee with the decision number 2021.09.12 on 16.09.2021. An informed consent form was signed by all patients participating in the study. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Forty individuals diagnosed with stage 2 or 3 bilateral knee OA, according to Kellgren-Lawrence grading who applied to Kırıkkale University Faculty of Medicine Physical Therapy Outpatient Clinic, were included in the study. Individuals aged 45-65 years, with independent ambulation, grade 2 or 3 bilateral knee osteoarthritis according to the Kellgren and Lawrence Classification, and who did not use nonsteroidal anti-inflammatory drugs in the last 5 days were included in the study.[14-15] Patients with a history of surgery in the lower extremities, neuromuscular disease, vestibular pathology, congenital problems that may affect independent walking in the lower extremity, difficulties in communication and cooperation, who received physiotherapy or injection into the joint in the last 6 months, or who regularly exercise were excluded from the study.[14-16] All individuals were evaluated before taping and 30 minutes after taping. Age, height, weight, body mass index (BMI) of the individuals participating in the study were questioned and recorded. While facilitation taping was applied to the Rectus femoris muscle of the individuals in the intervention group for 30 minutes, placebo taping was applied to the Rectus Femoris muscle of the individuals in the placebo group for 30 minutes.

Pain and functional disability were evaluated with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) before and immediately after kinesio taping or placebo taping was applied to individuals included in both groups. Kinesio and placebo taping was performed by a certified physiotherapist trained in this field. The same physiotherapist performed all the measurements, so that there was no difference between the measurements.

Taping Application

Tape (Kinesio Tex Tape) 5 cm wide and 0.5 mm thick was used in both groups. Facilitation taping technique was applied according to the Kenzo Kase application in the KT group, and sham tape was applied in the placebo group. The rectus femoris muscle was taped according to the "kinesiology taping guide" book published by Kenzo Kase .[17]

Before taping, individuals were seated and rested for 10 minutes. If all individuals had hair in the area to be taped, this area was freed from hair. Then this area was cleaned with alcohol and the taping was started. Superior Y technique was applied to all individuals. The tape, which was cut by measuring the patient's length, was divided into two at one end and given a 'Y' shape. Kinesio and placebo taping were applied to both rectus femoris muscles in all patients. The tape remained for 30 minutes in all individuals .[18] Individuals waited in sitting position until the second evaluation after taping. Facilitation taping was applied to the Rectus Femoris muscle of the patients included in the KT group. For facilitation taping, individuals were positioned in the supine position with their legs hanging from the bed from their knees. The kinesiology tape was fixed 10 cm below the origin of the rectus femoris without any tension. Then, 35-50% tension was given to the band, and it was descended to the patella. After this point, the banding was terminated in such a way that the Y-shaped band wraps the patella medially and laterally without any tension .[17]

The individuals included in the placebo group, on the other hand, were placed on the Rectus Femoris muscle without any tension while lying in the supine position.

Outcome Measure

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC): It is a 24-item scale consisting of three subsections: pain, stiffness, and physical function. It was created to evaluate patients with hip and knee OA. The questions in each section can be given a minimum of 0 and a maximum of 4 points.

The highest score was 20 for the pain subsection, 8 for the stiffness subsection, and 68 for the physical function subsection. Turkish validity and reliability study was conducted by Tüzün et al.[19]

Statistical analysis

Data analysis was performed using SPSS 23.0 (SPSS Inc., Chicago, Illinois, USA). As descriptive statistics, appropriate measures such as frequency and percentage for qualitative variables, mean, standard deviation and median for quantitative variables were given. The Shapiro-Wilk normality test was used to determine whether the distribution of quantitative variables conformed to the normal distribution. In cases where the parametric test assumptions were met, whether there was a difference between the intervention and control groups in terms of the 1st and 2nd measurement values was examined with One-Way Analysis of Variance in Repeated Measurements. The level of significance in the analyzes was taken as 0.05. If the parametric test assumptions were not met, comparisons between independent groups were made with the Mann-Whitney U Test, and comparisons between dependent groups were made with the Wilcoxon Test. The formula $r = Z/\sqrt{n}$ was used for the effect size of the data not normally distributed ($r = 0.10$ small effect, $r = 0.30$ moderate effect, $r = 0.5$ large effect). The formula d= Mean_difference / SD_ difference (Cohen's d was used for the effect size of normally

distributed data (d = 0.2-0.50 small effect, d = 0.50-0.80 moderate effect, d = 0.8 large effect. Post-hoc power analysis was performed to determine the strength of the present study. For post-hoc power analysis, G Power program (version 3.0.10 Universit€at Dusseldorf, D € usseldorf, € Germany) was used. In post-hoc power analysis, the alpha statistical significance was 5% and the confidence interval was 95%, and the power of the study (1-b) was 72%. The primary outcome was the WOMAC total score.

RESULTS

Forty individuals with a mean age of 55.93±5.44 years and diagnosed with stage 2 or 3 bilateral knee OA according to Kellgren-Lawrence grading were included in this study. The mean age of the intervention group was 55.65±4.44 years, and the mean age of the placebo group was 56.20±6.40 years. No statistically significant difference was observed between the two groups in terms of age, height, weight and BMI (p>0.05) (Table 1).

Table 1. Comparison of demographic features of the groups

Variables	KT Group Mean±SD	Placebo Group Mean±SD	p value
Age (year)	55.65±4.44	56.20±6.40	0.754
Height (cm)	155.93±36.96	154.68±36.72	0.512
Body Weight (kg)	86.18±14.87	83.45±10.54	0.738
Body mass indeks (kg/m^2)	31.98±6.04	31.57±4.14	0.583

SD: Standard Deviation;,KT: Kinesio tape; cm: centimeter, kg: kilogram, %: percentage n: participants BMI: Body Mass Index, *p<0.05

WOMAC results measured before taping were found to be statistically similar (p>0.05). When the WOMAC results of the patients before and after taping was compared, there was a significant decrease in the WOMAC pain (p=0.001, z=15.221), WOMAC function (p=0.012, z=7.036), WOMAC total score (p=0.003, z=-2.934) after taping in KT group. However, WOMAC stiffness results 30 minutes after taping was not statistically significant in either KT or placebo groups (p>0.05) (Table 2).

Compared with the placebo group, there was no statistically significant difference was found between the changes in the WOMAC pain, WOMAC stiffness, WOMAC function, WOMAC total scores (p>0.05). The mean change in WOMAC pain was -1.37 for the KT group and -0.73 for the placebo group (p =0.157). The median change WOMAC stiffness was 0.00 for the KT group and the placebo group (p =0.547). The mean change WOMAC function was 2.21 for the KT group and -0.99 for the placebo group (p =0.157). The median change in WOMAC total score was -3.65 for the KT group and 0.00 for the placebo group (p =0.056) (Table 3).

DISCUSSION

In our study in which we examined the instantaneous effect of kinesio taping applied to the rectus femoris muscle on rectus pain and functional disability in knee OA patients, an instant decrease was observed in the WOMAC total score in the intervention group compared to the placebo group after a single session of kinesio taping. There was an immediate decrease in WOMAC pain and function scores after taping in both the KT and placebo groups.

Both groups included in our study showed homogeneous distribution in terms of age, BMI, gender distribution,

Table 2. Results of WOMAC in KT and placebo taping groups

Variables	Pre-taping Median (Min-Max) Mean±SD	Post-taping Median (Min-Max) Mean±SD	P[1]	z	
WOMAC pain (score)	KT Group	12.67±4.47	11.30±5.23	0.001*	15.221
	Placebo Group	12.50±3.64	11.77±3.92	0.064	14.567
p[2]	0.369	0.678			
	(z=-0.906)	(z=-0.433)			
WOMAC stiffness (score)	KT Group	3.45 (1.03-13.62)	3.38 (0.06-17.14)	0.823	-0.224
	Placebo Group	3.69 (1.36-42.57)	3.80 (1.05-37.46)	0.794	-0.261
p[2]	0.914	0.240			
	(f=0.012)	(f=1.426)			
WOMAC function (score)	KT Group	42.71±13.44	40.50±15.14	0.012*	7.036
	Plascebo Group	37.55±11.97	36.56±12.23	0.097	6.047
p[2]	0.280	0.318			
	(f=1.202)	(f=1.202)			
WOMAC total (score)	KT Group	64.06 (18.75-87.50)	56.77 (6.66-87.50)	0.003*	-2.934
	Placebo Group	56.25 (16.66-79.16)	53.64 (16.66-79.16)	0.091	-1.690
p[2]	0.231	0.758			
	(z=-1.204)	(z=-0.311)			

[1]compare variables within tests (Pre-versus Post taping).
[2]compare variablesbetween groups (KT group versus Placebo group).
*Statistical significance is set at p<0.05.
z: Wilcoxon signed-rank test
F: One-way analysis of variance test
KT: Kinesio Taping, WOMAC:Western Ontario and McMaster Universities Osteoarthritis Index SD: standart deviation, n: participants, Min:Minimum, Max:maximum

Table 3. Change in WOMAC in KT and placebo taping groups

Variables	KT Group	Placebo Group		
	Median (Min-Max) Mean ±SD	Median (Min-Max) Mean ±SD	p values	Effect size
Change in WOMAC_pain	-1.37± 1.65	-0.73± 1.76	0.157	0.38
Change in WOMAC_stiffness	0.00 (-5.21-0.00)	0.00 (-1.04-0.00)	0.547	0.47
Change in WOMAC _function	-2.21± 4.62	-0.99± 2.78	0.157	0.32
Change in WOMAC_ total score	-3.65 (-60.00-0.00)	0.00 (-13.54-2.09)	0.056	0.60

KT: Kinesio Taping, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index SD: standart deviation, n: participants, Min:Minimum,Max:maximum
*Statistical significance is set at p<0.05.

and educational status. Muscle activation and the sense of proprioception of the knee joint decrease with age.[20,21] Therefore, it is important to include individuals in the similar age range in the study. High BMI negatively affects muscle activation, physical performance, and proprioception.[22] Therefore, it is important to include individuals with similar BMI in a study on these variables. It is known that women have lower muscle activation, physical performance, and therefore worse proprioception than men.[23] Therefore, it was important that the gender distribution of the individuals in our study was homogeneous between the groups.

Articular cartilage can be damaged by normal wear and abnormal mechanical loading, resulting in abnormal cellular activities in the cartilage and synovium, resulting in stiffness, loss of range of motion. Joint function is an important parameter to evaluate the effectiveness of treatment in knee OA, and WOMAC is one of the most commonly used functional and disability scores [24] For this reason, WOMAC was used to evaluate pain and functional disability in the current study. Kinesio Taping can be an inexpensive and convenient option aimed at reducing symptoms and improving function. Intra-articular aseptic inflammation can be reduced using Kinesio Taping. One meta-analysis noted that Kinesio Taping recorded improvements in WOMAC outcomes over placebo taping. However, in this meta-analysis, the follow-up period of the interventions was stated to be variable between 3 days and 3 months for both the banding and control groups with the WOMAC outcome measures 5

In a review study, it was stated that although KT was effective in the treatment of knee OA in most studies, there were very few studies that did not report its beneficial effect on knee OA 6 For example, the study by Wageck et al.[25] reported that KT had no beneficial effect on any of the outcomes evaluated for people with knee osteoarthritis. This is probably due to the short time (4 days) participants had KT, which may not be long enough to confer any real benefit in knee osteoarthritis. Conversely, trials by Rahlf et al.[15] noted a discrepancy with Wageck's claim that KT had beneficial effects on short-term (three days in a row) pain relief, reducing joint stiffness, and increasing knee function. The reason for this difference; Wageck et al.[13] stated that the follow-up time may be due to the taping technique (administration of placebo of tension-free CT for the control group). In these studies, in addition to the method of measuring pain directly, two questionnaires (Lysholm and WOMAC) containing questions about pain were also used, and the score was analyzed from the WOMAC questionnaire from the pain domain. The study of Koçyiğit et al.[11] reported that there is inconclusive evidence that KT has a beneficial effect over placebo taping in knee osteoarthritis. It has been stated that the reason for this may be that the Lequesne index is not sufficiently sensitive and responsive to document changes in a short time period and there is no untreated control group.

In a study examining the instantaneous effect of kinesio taping applied to knee OA patients on WOMAC results, an instant improvement was obtained in the WOMAC total score in the intervention group compared to the placebo group 26. In our study, we also achieved an immediate positive improvement in the WOMAC total score in the intervention group with kinesio taping compared to the placebo group.

Pinherio et al.[27] concluded that the change in the WOMAC results of a single session of kinesiology taping applied to knee OA patients in the intervention group was not different from the placebo group. We also obtained a similar result for WOMAC pain and function in our study. In the sub-section of detention, no significant improvement was observed in either group. We think that this is due to the short implementation time in our study. Studies examining the immediate effect of KT taping on WOMAC pain and functional disability are limited in the literature, so there is a need for more studies examining both long-term and short-term effects.

There are views that KT increases local blood flow by increasing the interstitial space due to the area-reshaping lifting effect as a result of the folds formed on the skin28. Therefore, some studies have demonstrated that KT application affected lymphatic and blood circulation with its impact on the subcutaneous cavity, decreased pain and inflammation and accelerated healing, and positively affected functional disability.[9-29] However, data on which taping method are more effective is insufficient. For these reasons, in our study, we aimed to investigate the instant effect (30 minutes) of KT on pain and functional disability. As a result of this study, we obtained positive results on pain and functional disability after 30 minutes KT taping.

There are some limitations to this study that should be emphasized. First, all participants were recruited from a single center, which makes it difficult to generalize the results. Secondly, the fact that the tape we applied to the placebo group was the same as the kinesiology tape we applied to the intervention group may have affected the results of the placebo group. The WOMAC questionnaire is a questionnaire that should be administered at least two days apart. In our study, in which we evaluated the instantaneous effect of kinesiology taping, the 30-minute interval between the WOMAC questionnaire applied before and after taping may have affected the results. Third, the long-term effects of our 30-minute KT application were not examined. Long-term effects such as 24 hours, 72 hours and 1 month later could also be examined.

CONCLUSION

In conclusion, positive changes were detected in the WOMAC total score 30 minutes after KT application in patients with knee OA. We think that this result will contribute to the literature lacking information on the immediate effect of kinesiology taping on knee OA patients. In line with these results, we think that kinesiology taping can be used as a complementary treatment to instantly increase the effectiveness of knee OA rehabilitation as an easily applicable method due to its positive effect on functional disability.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Kırıkkale University Non-invasive Researches Ethics Committee (Date: 16.09.2021, Decision No: 2021.09.12).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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